

SECURITY AND AUTHENTICATION OF POSTAGE INDICIA

BACKGROUND OF THE INVENTION

5 This invention relates to postage indicia printed on mail items and to the provision of security and authentication of said indicia.

Postage meters have been utilised over a long period to print postage indicia on mail items, the postage indicia indicating that postage has been applied to the mail item and that accounting has been effected in respect of the applied postage. Known postage meters include an electronic circuit for carrying out accounting functions in relation to amounts of postage charges applied to mail item. The electronic circuit receives an input of a desired postage charge to be applied to a mail item, carries out accounting in respect of the required postage charge and then operates a printer of the postage meter to print a postage indicium on the mail item. Generally the postage indicium includes at least the postage charge, the date on which the indicium is printed and an identification of the postage meter.

Previously, the printer of the postage meter comprised a
25 rotatable drum printer in which a die plate carried by the
drum printed fixed invariable information of the indicium
and settable print wheels carried by the drum printed
variable information of the indicium. The fixed
invariable information comprises a graphical pattern, a
30 meter identification number and the originating postal
region for the mail. The variable information comprises
an amount of the postage charge and the date of printing
the indicium.

35 The postage meter is constructed in a secure manner by
being housed in a secure housing and the printing means
which prints the indicium is constructed to work

[illegible]

integrally with the meter and also is secure. Accordingly the indicia is printed under conditions of security and attempts to operate the meter and printer in a fraudulent manner in which indicia are printed in
5 respect of postage amounts for which accounting has not been effected are prevented.

However in order to provide additional security with respect to the postage amounts applied to mail items it is
10 desirable that the indicia on the mail items include authenticating information whereby the authenticity of the indicia can be verified. By including this authenticating information it is possible, by examination of indicia on mail items, to detect indicia which are not genuine and
15 purport to represent postage charges. No accounting for the postage charges represented by such non-genuine indicia will have been effected so that such indicia have been produced in a manner which results in fraud on the postal authority or other carrier.

20 Postage meters currently available are provided with a digital printer in place of the drum printer. The digital printer is controlled by the electronic circuit of the postage meter to print in a series of cycles a pattern of
25 dots to form the complete indicium. It will be appreciated that, whereas the indicium printed by the drum printer of earlier postage meters is invariable apart from the value of postage charge and date, the digital printer of currently available postage meters is capable of
30 printing an indicium containing significantly more variable information. Due to the increased flexibility and capability of digital printers as compared with drum printers it is possible to print additional information in the indicium which can be utilised to authenticate the
35 indicium whereby indicia printed in an unauthorised manner can be recognised and differentiated from indicia printed in an unauthorised manner by an unauthorised postage

meter.

SUMMARY OF THE INVENTION

According to a first aspect of the invention a method of
 5 generating an indicium for printing on an item includes
 the steps of storing a key; generating a modified key from
 the stored key in dependence upon first data to be
 included in said indicia; utilising the modified key in
 conjunction with second data to be included in the indicia
 10 to generate an authentication code and printing the
 indicium, said indicium including said first and second
 data and said authentication code.

According to a second aspect of the invention a method of
 15 authenticating an indicium including data and an
 authentication code for authentication of said data
 includes the steps of selecting a stored key; utilising
 said data to generate a modified key from said stored key;
 utilising said modified key and said data to generate an
 20 authentication code and comparing the generated
 authentication code with the authentication code included
 in the indicium.

According to a third aspect of the invention postage
 25 meter apparatus includes means storing a secret key; input
 means for the input of postage data; electronic control
 means operative to read the secret key and to modify the
 secret key to generate a modified secret key in dependence
 upon and the postage data, said electronic control means
 30 being operative to utilise the modified secret key to
 generate an authentication code dependent upon the postage
 data and being operative to print an indicium containing
 the postage data and the authentication code.

35 According to a fourth aspect of the invention a postage
 meter includes a register storing a value of postage
 dispensed by the postage meter in a determined period and

means to generate a control value dependent upon the value stored in said register and to include a code value dependent upon the control value in an indicium printed on a mail item.

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BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention will be described by way of example with reference to the drawings in which:-

Figure 1 is a block diagram of a postage meter

10 Figure 2 illustrates machine information included in an indicium printed on a mail item,

Figure 3 is a flow chart illustrating steps carried out in generating authentication information to be printed in the indicium

15 Figure 4 is a flow chart illustrating steps in authenticating a printed indicium and

Figure 5 is a flow chart illustrating additional or alternative steps carried out in printing a postage indicium.

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DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to Figure 1 of the drawings, the postage meter includes electronic accounting and control means comprising a micro-processor 10 operating under program

25 routines stored in a read only memory (ROM) 11. A

keyboard 12 is provided for input of commands and data by a user and a display 13 is provided to enable display of information to the user. A random access memory (RAM) 14

is provided for use as a working store for storage of

30 temporary data during operation of the postage meter.

Non-volatile duplicated memories 15, 16 are provided for the storage of critical data relating to use of the postage meter and which is required to be retained even when the postage meter is not powered. The microprocessor

35 10 carries out accounting functions in relation to use of the postage meter for franking mail items with amounts of postage charges applicable to handling of the mail items

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by the postal authority or another carrier. Accounting data relating to use of the postage meter for printing franking indicia representing postage charges for mail items and any other critical data to be retained is stored in the non-volatile memories 15, 16. The accounting data includes a value of credit, an accumulated total of value used by the meter in franking mail items, a count of the number of mail items franked by the meter and a count of the number of mail items franked with a postage charge in excess of a predetermined value. The value of credit may be a value of credit available for use by the meter and stored in a descending credit register. The accumulated total value used by the meter is stored in an ascending tote register, the count of items is stored in a piece count register and the count of items franked with a postage charge in excess of a predetermined value is stored in a large items register. Alternatively, if desired, instead of a descending register storing a value of credit available for use by the meter, a total value of credit entered into the meter may be stored in an ascending credit register.

As is well known in the postage meter art, each of the registers referred to hereinbefore for storing accounting data is replicated in order to enable integrity of the accounting data to be maintained even in the event of a fault or termination of power to the meter during a franking operation. Two replications of each of the registers are provided in each of the memory devices 15, 16.

A motor controller 17 is controlled by the microprocessor 10 to control operation of motors 18 driving feeding means (not shown) for feeding a mail item past a digital print head 19. The digital print head 19 may be an impact print head in which print elements are impelled selectively to impact with an ink ribbon to transfer ink to a mail item

or any other form of digital print head and for example may be a non-impact print head. It is preferred to use a non-impact print head such as a thermal print head operating as described hereinafter. The thermal print head includes a plurality of selectively energisable thermal printing elements 20. Sensors 21 are provided to sense and monitor feeding of the mail item. The sensors provide signals to the microprocessor to enable the microprocessor to control feeding of the mail item and to energise selectively the thermal print elements 20 of the print head at appropriate times as the mail item is fed past the print head. As the mail item is fed past the thermal printing elements 20 of the print head 19 during a printing operation, the microprocessor outputs on line 22, in each of a series of printing cycles, print data signals selecting those ones of the printing elements 20 which are to be energised in each respective printing cycle. A pulse of electrical power is supplied to the selected thermal printing elements from a power source 23 when a strobe signal is supplied by the microprocessor on a line 24 to the print head. When printing a bar-code, a plurality of adjacent thermal printing elements are energised in selected printing cycles such as to print narrow and wide bars as required to represent data. The bars may all be of the same length in which case the same number of thermal printing elements are energised in each of the selected printing cycles. However when it is desired to print bars of selected different lengths, the number of thermal printing elements energised in each selected printing cycle is selected to correspond to the required length of bar to be printed.

It will be appreciated, as is well known in the postage meter art, that the postage meter must operate in a secure manner and be protected from attempts to use the meter fraudulently for example by utilising the postage meter to print franking indicia on mail items for which no

corresponding postage charge has been accounted for by the accounting means. Accordingly those parts of the postage meter required to be secured against unauthorised tampering are housed in a secure housing 28.

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In so-called prepayment operation of a postage meter, each time a franking operation is to be performed, the micro-processor carries out a routine in which a determination is made as to whether the value of credit in the credit register is sufficient to permit the franking operation in respect of the required postage charge for a mail item to be performed. If the value of credit in the credit register is sufficient, the franking operation is continued and the accounting data in the registers is updated to account for the postage charge and the franking indicia is printed. However if the value of credit in the credit register is not sufficient to permit the franking operation in respect of the required postage charge to be performed, the operation is terminated and the franking indicia is not printed. Where a value of credit available for use in franking is stored in a descending register, the check as to sufficiency of the credit available is effected by a determination of whether the postage charge is less than the credit value. Where a total value of credit is stored in an ascending credit register the check as to sufficiency of credit is effected by a determination of whether the total value of credit is at least equal to the sum of the postage amount and the accumulated total value in the tote register.

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In addition to the security against fraudulent attempts to print postage indicia on mail items provided by the secure construction of the postage meter, additional security in respect of the postage indicia and for the postage amounts represented is provided by authentication data included in the indicia. The authentication data to be printed in the indicia is encrypted. The postage data together with the

encrypted authentication data information is printed on the mail item. The encryption of the data is effected using an algorithm and a secret key so that the encrypted information is not predictable from the data printed in the indicia. The validity of an indicium can be verified by carrying out the same encryption of the printed data and then comparing the resultant encrypted information with the encrypted information printed on the mail item. If the comparison is successful validity of the indicium is verified whereas if the comparison is not successful the indicium is regarded as not authentic. The process for generation of the encrypted information, if desired, may be a reversible encryption process whereby the encrypted information can be decrypted to yield the original data. When a reversible encryption process is used, verification of the indicium may be effected by decrypting the encrypted information printed in the indicium and comparing the decrypted information with the original data. Instead of utilising encrypted information for verification of the authenticity of the indicium a digital signature may be used.

To facilitate verification of the validity of the indicia it is desirable that the data and encrypted information or digital signature in the indicia is of a form which is machine readable. Accordingly the mail items can be fed through reading means to scan the indicia on the mail items and computing means coupled to the reading means carries out verification checks on the scanned indicia. Conveniently the postage data and encrypted authentication data are printed in a form suitable for optical character recognition or may be printed in the form of a bar-code. In addition to the machine readable information, the indicium may contain information in human readable form.

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Referring now to Figure 2 of the drawings, the figure illustrates an example of a format of postage data items

and encrypted information in a machine readable part of an indicium. The machine readable part of the indicium includes postage data comprising a meter vendor's or meter manufacturer's identification 30 provided by a single digit, a postage meter identification 31 provided by six digits, a piece count 32 of the number of mail items processed by the postage meter provided by five digits, a date representation 33 provided by a single digit, a postage amount 34 represented by a single digit and also includes a mail authentication code 35 of two digits comprising an encryption of authentication data. If desired the order of the items of data and may be changed and the encrypted authentication data 35 may be a digital signature instead of encrypted information. The representation of date by a single digit and the representation of postage amount by a single digit is described in our pending application GB 9623936.3. The '*' symbols are used in the figure to separate the various items of data in the indicia. However in practice if desired these symbols may be omitted or replaced by other means the only requirement being that each data item can be distinguished from a neighbouring data item.

Referring to the flow chart of Figure 3, the microprocessor of the postage meter reads (step 40) a secret key stored in the non-volatile memory 15, 16 and then modifies the secret key in a modification process. The modification of the secret key is effected in dependence upon a code generated (step 41) from data to be printed in the machine readable part of the indicium. A code number which may be a check digit or check digits is generated (step 41) from at least a part of the postage data and the code number is utilised in conjunction with an algorithm or look-up table to generate (step 42) a modified secret key. Thus the modified secret key will be unpredictable for each mail item and will vary in a random manner dependent upon the postage data. The modified

secret key is then utilised (step 43) with an algorithm to operate on at least a part of the postage data to generate the machine authentication code. Then an indicium containing the postage data and authentication code is printed (step 44) on the mail item and the routine in respect of that mail item ends (END 45).

Referring to the flow chart of Figure 4, when the mail item bearing a postage indicia including the machine readable part is received by a postal authority, the machine readable data is read (step 50) by a machine reading device such as a scanner and the output of the scanner is input to a postal authority computer. The computer utilises (step 51) the vendor identification and the postage meter identification to access a look-up table to determine the secret key appropriate to the postage meter that printed the indicia on the received mail item. The computer then modifies the secret key in dependence upon a code generated in dependence upon the postage data read from the mail item, in the same manner as the postage meter generated the modified secret key, to generate a modified key corresponding to the modified secret key generated by the postage meter. Thus the computer generates (step 52) the code from the postage data and utilises the code to generate (step 53) the modified secret key. The computer then utilises (step 54) the modified secret key with an algorithm to operate on the code generated from the postage data, in the same manner as the postage meter, to generate the mail authentication code 35. The computer then compares (step 55) the authentication code generated in step 54 with the authentication code read from the mail item. If the mail authentication code generated by the computer corresponds (YES output of step 56) to the mail authentication code read in the machine readable part of the indicia printed on the mail item the postage indicia is authenticated and is genuine and the mail item is accepted (step 57). The

authentication of the indicium for that mail item then ends (END 58). However if the mail authentication code generated by the computer does not correspond (NO output of step 56) to the mail authentication code read from the indicia, the indicia is not authenticated and is not genuine. The computer then operates to reject (step 59) the mail item as bearing an indicia which has been printed in a fraudulent manner and checking authentication of the indicium on that mail item ends (END 58). It will be appreciated that if the postage meter utilises only a part of the postage data to generate the code to modify the key and only a part of the postage data to generate the authentication code, the computer utilises the same part or parts of the postage data in generating the code to modify the key and to generate the authentication code.

Instead of modifying the key as described hereinbefore, or in addition to modifying the key, the data printed in the machine readable part of the indicium may include a control value dependent upon the accumulated value in the ascending register of postage dispensed by the meter and the credit value in the credit register and, for example, the control value may be dependent upon the sum of the accumulated value and the credit value. The control value may be equal to the sum of the accumulated value and credit value or may be derived from this sum. A routine, or a sub-routine to be incorporated in the routine illustrated by Figure 3, for printing an indicium containing a control value is illustrated by the flow chart of Figure 5. After initiation (START 60) of the routine or sub-routine, the control value is generated (step 61) and the indicium is printed (step 62), the indicium containing the control a value. If desired, where the steps of Figure 5 are a sub-routine, the sub-routine may be carried out between steps 43 and 44 of the flow chart of Figure 3.

The postage meter may be provided with registers in the non-volatile memories 15, 16 which store monthly totals of postage dispensed by the meter. For example, there may be two such registers, one storing the amount of postage
5 dispensed to date in a current period and which will continue to be incremented as postage is dispensed until the end of the current period and the other register storing the amount of postage dispensed in the period immediately preceding the current period. The start and
10 finish of each period is determined by a real time clock 29 communicating with the microprocessor 10. Conveniently each of the periods may be equal to one month. Instead of the control value being dependent upon the sum of the accumulated tote value and the credit value, the control
15 value may be dependent upon the values stored in one or both of these two registers. For example the control value may be a check digit relating to the register storing the postage value dispensed in the preceding period or may be a range indicator related to an amount of
20 postage predicted to be dispensed by the postage meter. The range indicator may be based on the amount of postage dispensed in the preceding period.

It is preferred that the indicia printed on the mail item
25 contains all the postage data required to enable authentication of the indicia at the postal authority. However, postage meters are subject to inspection at predetermined intervals either by physically taking the meter to the postal authority or by remote inspection via
30 a communication link and in the course of such inspections data is read from the registers of the meter. Accordingly one or more items of postage data additional to those included in the postal indicia printed on the mail item may be communicated to the postal authority during each
35 said inspection of the postage meter and these additional items of data may be utilised by the postal authority computer in authentication of the indicia printed on the

mail items.

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Variable	Mean	Standard deviation	Minimum	Maximum
Age	34.5	10.5	20	55
Gender	0.5	0.5	0	1
Marital status	0.5	0.5	0	1
Education	12.5	1.5	10	15
Income	15.5	5.5	10	25
Health status	0.5	0.5	0	1
Smoking status	0.5	0.5	0	1
Alcohol consumption	0.5	0.5	0	1
Exercise frequency	0.5	0.5	0	1
Stress level	0.5	0.5	0	1
Sleep quality	0.5	0.5	0	1
Work satisfaction	0.5	0.5	0	1
Life satisfaction	0.5	0.5	0	1